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NATURAL HISTORY IN THE GRADES

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II. SECOND GRADE

For a brief statement of the general plan of organizing the work in natural history for the grades the reader is referred to the November *Elementary School Teacher.* In each article of this series, in addition to outlining the materials to be used in the grade under discussion, some of those materials will be selected for a more detailed treatment in order that the method of work may be indicated. In the last article, the garden work, earth materials, and climatology were selected for detailed suggestions and the directions there given should be kept in mind in following up the work in those subjects in succeeding grades, though later further details will be given. In the Second-Grade outline, after the statement of topics to be included, the work in animal life is discussed more at length.

It must be kept in mind that the "what" and "why" attitude of the First Grade still is dominant in this grade, but work that is somewhat more prolonged and a little more investigative in character may well be undertaken. The First-Grade acquaintances in nature should be reviewed, and used as the starting-point, and subsequently used for constant reference. Indeed all First-Grade topics should at some time be used again in the Second Grade, else they will be forgotten. Repetition is essential, but this repetition now comes in connection with and as the basis of new work. The following materials are used in this grade:

1. *Animal life.*—A pair of rabbits, or a pair of nesting pigeons or doves; life cycle of the toad; blue-bird, red-headed woodpecker, grackle, junco, yellow warbler, gulls, the passing of wild ducks and geese, birds that remain through the winter, nesting habits of robin and English sparrow; dragon-fly, honey-bee, bumble-bee, wasp and nest, ants and nest, and the community life and activities of insects; caterpillar, cocoon, and adult butterfly or moth; grow in the room any common butterfly or moth through its life cycle, or a silkworm and moth in case such is available.

2. *Plant life.*—Plants of the farm such as corn, wheat, oats, millet, rice, and the materials derived from these that are used by man and his domesticated animals; sunflower, wild aster, goldenrod, cat-tails, water lily, plantain, thistle, evening-primrose, ash, cottonwood, hickory, black walnut, pine; seeds of several kinds of common plants; the fruits of wild plants, such as grapes, cherries, Indian currant, and nuts.

3. *Garden work.*—Window boxes containing house plants and a box or bed of bulbs some of which are different from those grown in the First Grade. Indoor gardening should be carried on throughout the year. In the outdoor garden the children of this grade should have one group garden or a few group gardens each in charge of a smaller group of pupils. Children of this grade should do their own planting and cultivation. The plants used should include some of those grown by First-Grade pupils but also some additional ones. The addition of a few of the less common plants as gourds and peanuts add interest. If three or four group gardens are used, interest is increased by having one group grow house plants—geranium, nasturtium, Coleus—another, radish, lettuce, and beets, another, pumpkins, another gourds, and another peanuts. Records of the garden work should constantly be made in written work and in sketches.

4. *Earth materials.*—Action of waves upon stones and sand, weight of stones as compared with water and wood studied by weighing and by displacement, and their properties such as hardness, color, and composition. Each child should be encouraged to make a collection of stones of different kinds.

5. *Physical and meteorological materials.*—In connection with the study of earth materials are included elementary experiments and observations upon physical and meteorological phenomena associated with changes in the condition of materials. These include a study of water, steam, fog, clouds, dew, rain, snow, frost, hail, ice, air, and air currents. The plan for study of climatology in the preceding year may again be used advantageously in this connection, but the work should be based upon schoolroom experiments in evaporation, boiling, and condensation, and upon careful observations of out-of-door phenomena.

In addition to acquaintanceship with all the animals included under "animal life," and some knowledge of their homes and habits there is made a careful study of the more conspicuous features of three life cycles—that of a dove or pigeon, of a moth or butterfly, and of the toad. As will appear in discussions of the outline for succeeding grades, there is arranged a series of life cycles of increasing complexity, so that there may be developed in a logical and natural way an understanding of the significance of the life round from one generation to another. To this end a pair of tame birds as pigeons or doves may be kept within the room and observed through all the nest building processes. We have had several pigeon nests built while under constant observation by children, and with never-ending interest on the part of all who observed the process. Indeed, old and young students find something new in the habits of each pair of these birds as they build their nests. Immediately following the completion of the nest, sometimes before, there appear the eggs, first one, then the second, and the period of incubation has begun. Questions such as the following help to give the study definiteness and also to insure that important points will not be omitted. Such questions do not remove opportunity for spontaneity in observation. In answering these questions the children should place on the board or upon a special pigeon-nest-calendar the dates and times of day on which various events are observed. Accurate records have great value in such work. Did incubation begin before the second egg was laid? How many days were used in building the nest? How many until egg laying was finished? How many were consumed in incubation before the first young were hatched? Did both young birds hatch on the same day?

During the period of incubation there are also many things to be observed, as: Does one parent do all the sitting? If not, do they divide the time equally? Do they behave in the same way? Does one parent ever feed the other? Do they "handle" their eggs in any way? Do they repair their nest while sitting? Do they make the same sounds while sitting as before? Do they eat as before? How do they behave when the young birds begin to hatch? How do the young birds get out of the shells of the eggs? What is the appearance of the old shell? How do the parents feed the young birds? Do both parents feed them? When do the first feathers appear? When do the young birds first stand up? How do they act? When do they leave the nest? While studying these and similar questions records should constantly be kept on the chart, by means of simply written stories, by numerous sketches, and sometimes by modeling in clay.

Not infrequently a robin or other common bird may nest upon a window ledge or so close to the schoolroom that it may be studied, though rarely would its nest enable pupils to observe closely enough to answer many of the above questions. (For suggestions upon the study of a robin's nest see an article by Jessie R. Mann in *The Nature Study Review,* Vol. IV, No. 9, pp. 265–71.)

Another life-cycle study used in this grade is that of the moth or butterfly. This is best studied by use of one of the larger moths as the Cecropia whose caterpillar stage often may be found in the autumn after the opening of school. The feeding habits of this caterpillar are so ravenous that children are stimulated to extreme interest in observing it, and in attending to its needs. The caterpillars may readily be removed from the plants upon which they are feeding (often the willow) and carried to the schoolroom. A supply of leaves of the kind that were being used as food should also be taken, though these must be replenished daily in order that fresh food may be had.

Various kinds of cages may be used. A pasteboard box with holes punched in the cover and sides is sometimes used, this having the disadvantage of darkness and difficulty of maintaining cleanliness. A small wooden box with wire or cloth netting over the top makes a better cage, but better than either of these is one constructed by use of a lamp chimney. Over the top of a large lamp chimney (the larger the better) tie a piece of netting, this being for ventilation. In a glass dish or earthen pot put one and a half or two inches of sand or porous soil. Upon the sand place the lower end of the lamp chimney. The sand or loose soil will absorb the moisture of the excretions from the caterpillar and by being renewed every two or three days enables the children to keep the cage attractive.

When placing the caterpillars within this cage put in a few twigs bearing the kind of leaves which are known to serve as food, inserting the base of the twigs into a small bottle or dish of water. Several kinds of willow leaves serve well as food for the Cecropia caterpillar. In connection with feeding these insects, interesting experiments may be made to determine the quantity of food eaten in a given length of time. Count and weigh the leaves put into the cage in one day. Also weigh the caterpillar in the morning before putting in the fresh leaves, and by weighing the caterpillar and the leaves that are left see how the weight of food eaten by it in one day compares with its own weight. A liberal supply of leaves should be put into the cage since the caterpillar eats almost constantly during the day. Does it eat at night?

Immediately before the period of cocoon spinning the caterpillar is likely to be rather sluggish. Constant watch should be made for the beginning of spinning, since it is a sight of extreme interest and instructiveness. From the appearance of the first threads of silk until the cocoon is complete may sometimes be a surprisingly short time—an hour or two—or it may be prolonged throughout a day. The pupils should see as much as possible of this process, and the gradual disappearance of the caterpillar within his cocoon, else the future developments will be unrelated to things already seen. Indeed to many grown-ups the performance of the apparent impossibility of development of the large, highly decorated and striking form of the adult moth from the caterpillar or from the apparently dead cocoon and contents (chrysalis) is a never-ending surprise. It is one of the wonders of nature's truths, no less wonderful than many improvised and truthless stories of nature.

The cocoons should be placed where they may remain undisturbed until the moth emerges. Especially must there be no handling of the cocoon during the first stages of the emergenc of the moth, since at such a time it may very easily be killed. Should both male and female moths be secured it is possible to keep them in a cage—a cage at least a foot or more in inside dimensions—to secure the eggs. If these may be placed upon proper kinds of leaves the young caterpillars may be secured and observed through the earlier stages of their development.

A third life-cycle study suggested for this grade is that of the toad. In the first grade the toad was studied in so far as its ways of living and habits in general could be observed. The acquaintance thus developed is used in early spring in the Second Grade as the beginning point at the time when frog's eggs begin to appear in ponds and along banks of streams. Collect these eggs (the toad's eggs are in strings, the frog's in clumps or masses) and place in an aquarium in the schoolroom. The water in the aquarium must be shallow or aeration must be had by blowing air into the water several times per day. If abundant plant material is growing in the aquarium sufficient oxygen will be produced, and also sufficient slime to nourish the hatching tadpoles for a time. If not too many are placed in one aquarium (25 to 40 tadpoles may be kept in a dish one foot in diameter) they will be able to get sufficient food from slime and small plants that should be secured from ponds or streams and placed in the aquarium at intervals of two or three days. Careful observation should be made concerning the development, movement, and feeding habits and these should be recorded in written work, stories, and drawings. One pupil has prepared a clay model life-history series of the toad which illustrates admirably the changes that occur throughout the entire development. Excellent suggestions and directions for the carrying-on of work with the toad may be found in a pamphlet by S. H. Gage, *Teachers' Leaflets,* No. 9, College of Agriculture, Ithaca, N. Y., and in pp. 274–94 in Hodge's *Nature Study and Life.*